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Mizutani

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(54) **ELECTRIC MOTOR WITH REDUCED AXIAL FOOTPRINT**

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H02K 7/116 (2006.01)
H01R 39/38 (2006.01)
H02K 5/14 (2006.01)

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CPC ***H02K 7/1166*** (2013.01); ***H02K 5/148*** (2013.01); ***H02K 5/225*** (2013.01)

(58) **Field of Classification Search**
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USPC ..... 310/239, 242, 71, 75 R
IPC H02K 5/14
See application file for complete search history.

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(57) **ABSTRACT**

A motor includes a motor unit, a deceleration unit, and a connector unit. The motor unit outputs rotational drive force and includes a yoke housing, a commutator, a power supply brush, a conductive member, and a brush holder. The yoke housing has an open end in an axial direction. The conductive member is electrically connected to the power supply brush. The brush holder is arranged in the open end to hold the commutator, the power supply brush, and the conductive member. The deceleration unit includes a gear housing coupled to the open end. The connector unit is coupled to the gear housing and including a connection terminal electrically connected to the conductive member. The commutator and the power supply brush are arranged outside the yoke housing. The conductive member and the yoke housing are arranged on opposite sides of the commutator.

16 Claims, 9 Drawing Sheets

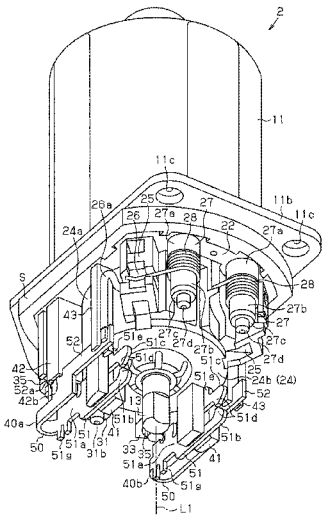

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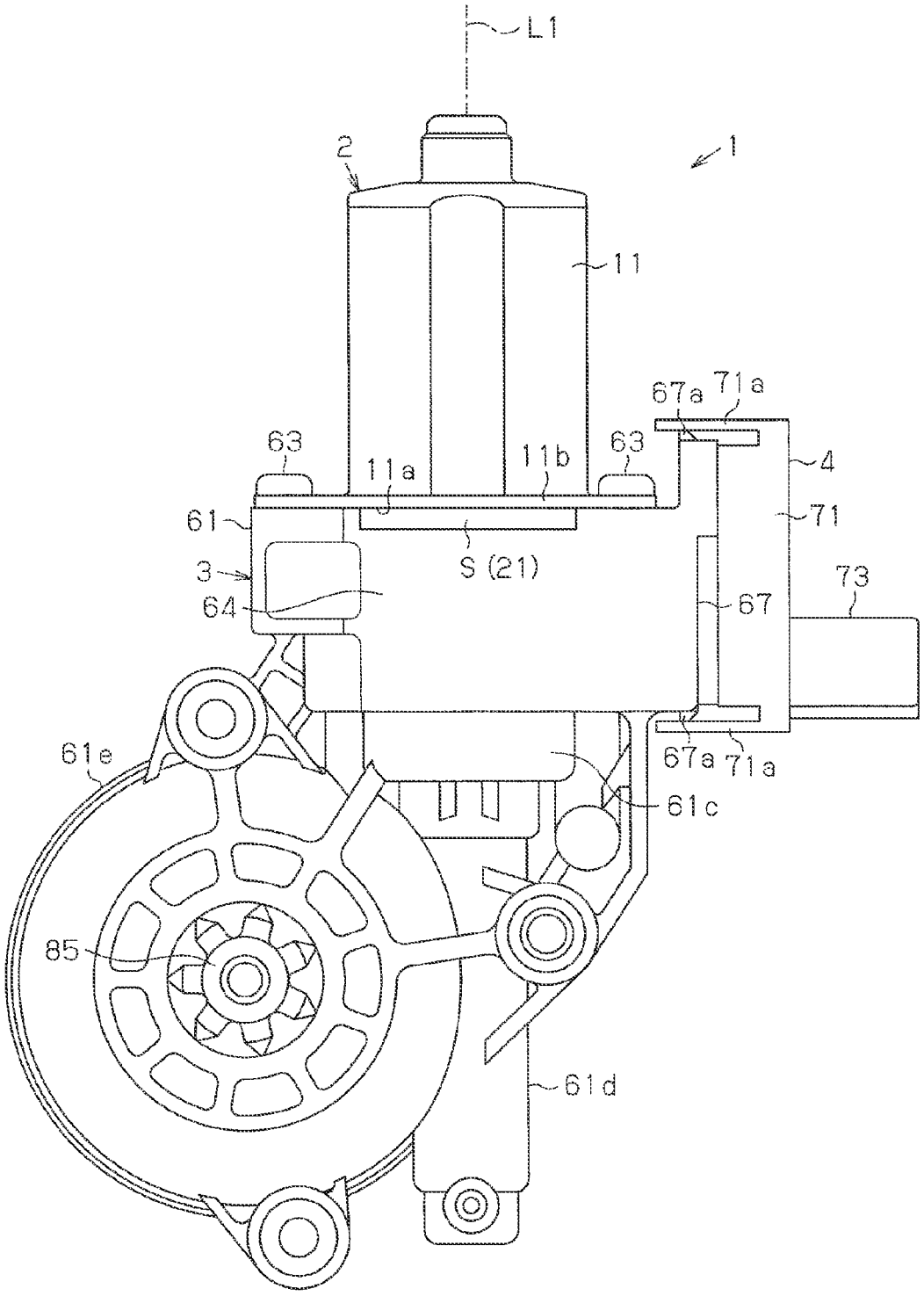
Fig.1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2
1
11
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71a
63
11a
11b
63
4
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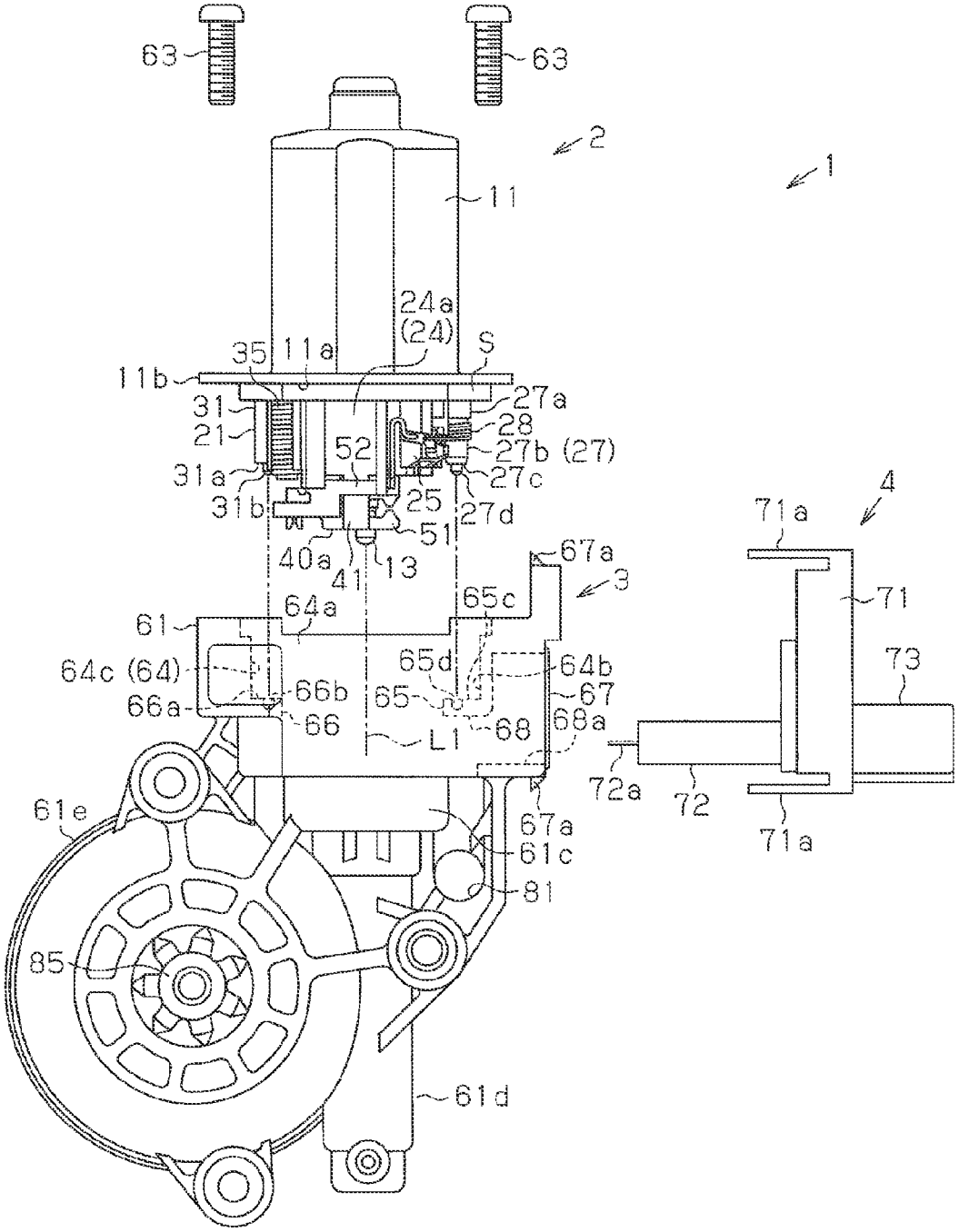
85
61d

Fig.2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11b
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27b (27)
27c
27d
52
25
51
40a
41
13
67a
3
65c
64a
61
64c (64)
66b
66a
66
65d
64b
67
65
68
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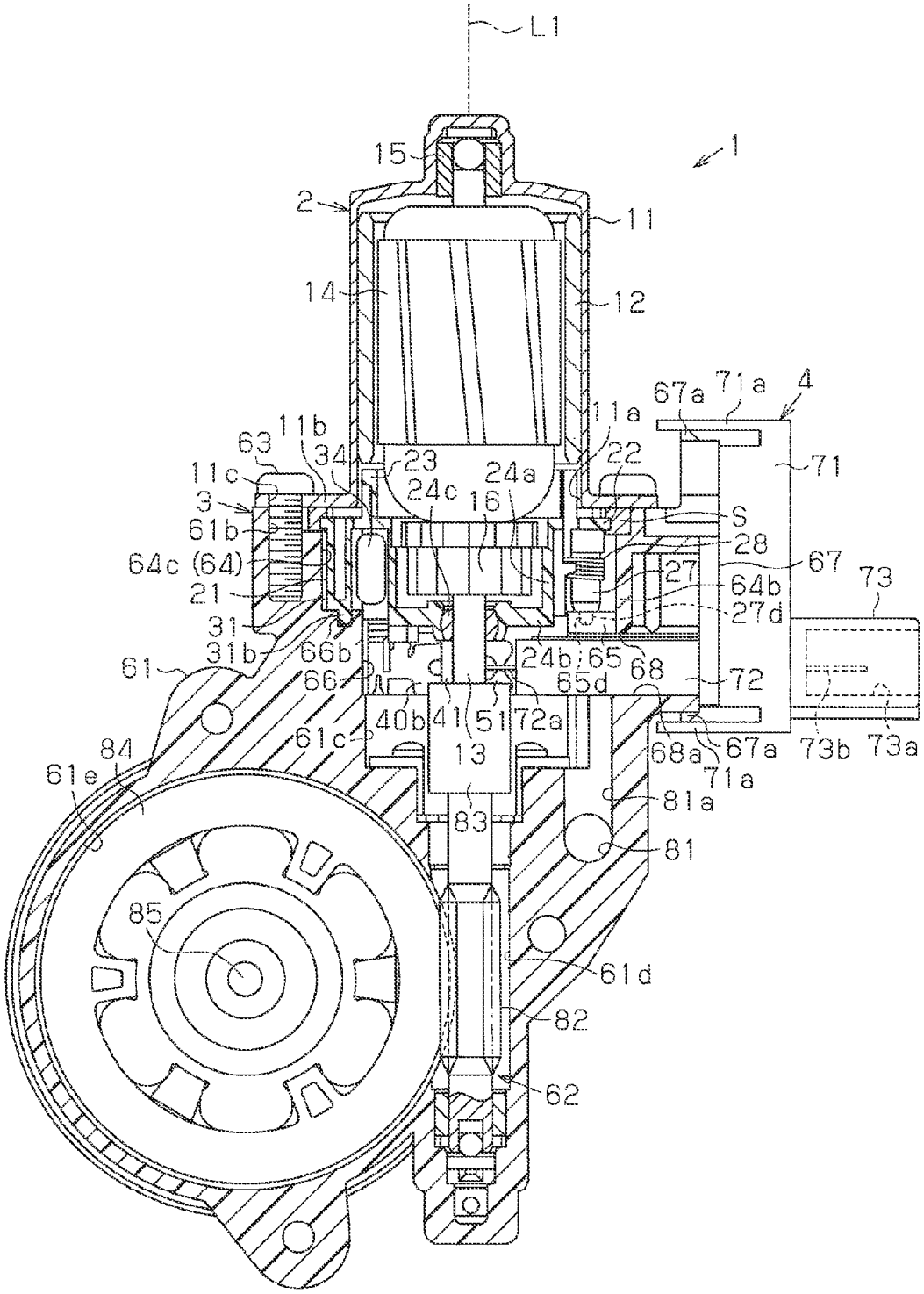
61e
67a
61c
81
85
61d

Fig.3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11b
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34
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24a
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24c
16
3
S
61b
28
64c (64)
27
67
73
21
64b
27d
31
31b
66b
24b
65
68
72
61
66
65d
40b
41
51
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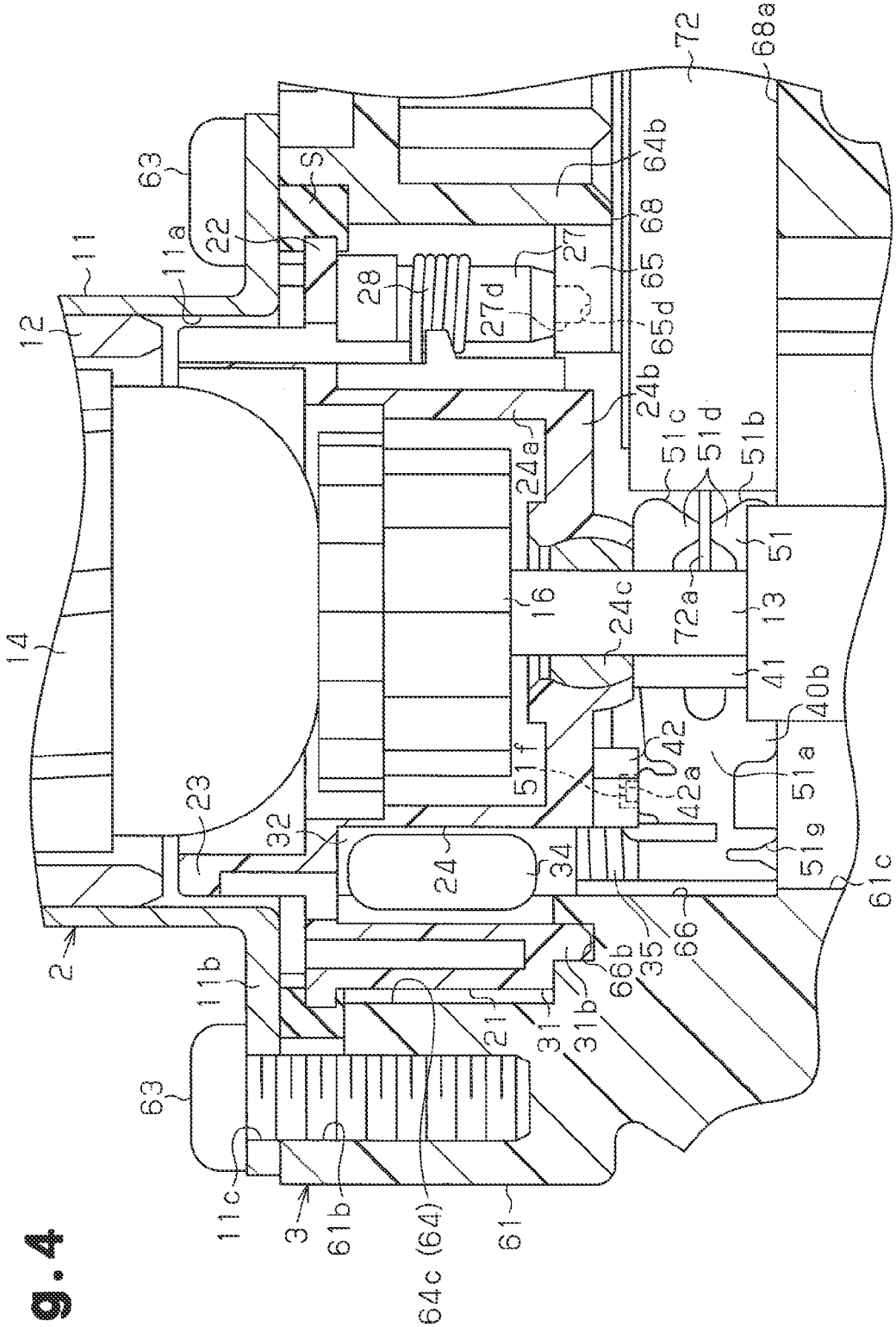
71a
81a
83
81
85
61d
82
62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63
S
64b
68
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65d
28
27d
11
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22
12
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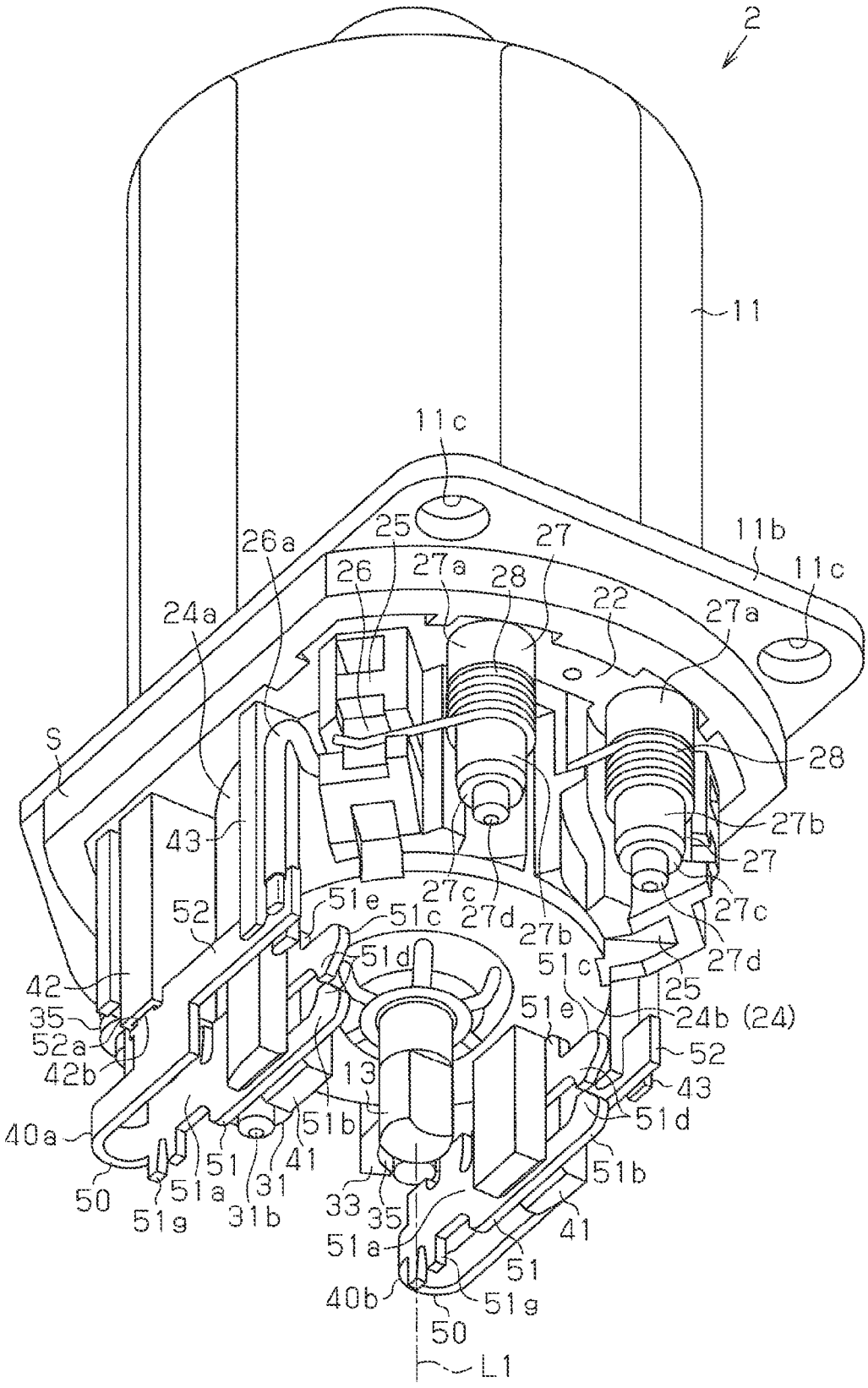
51b
51
16
24c
72a
13
41
40b
14
42
42a
51a
51g
51f
23
32
24
34
61c
2
66
66b
35
11b
21
31
31b
63
11c
3
61b
64c (64)
61

Fig. 4

Fig.5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11
11c
11b
11c
25
27
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26
27a
28
22
27a
24a
S
28
27b
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27c
52
51e
51c
27d
27b
51d
51c
27d
42
25
35
51e
24b (24)
52a
52
42b
13
43
40a
51b
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51g
31b
51a
51
40b
51g
50
L1

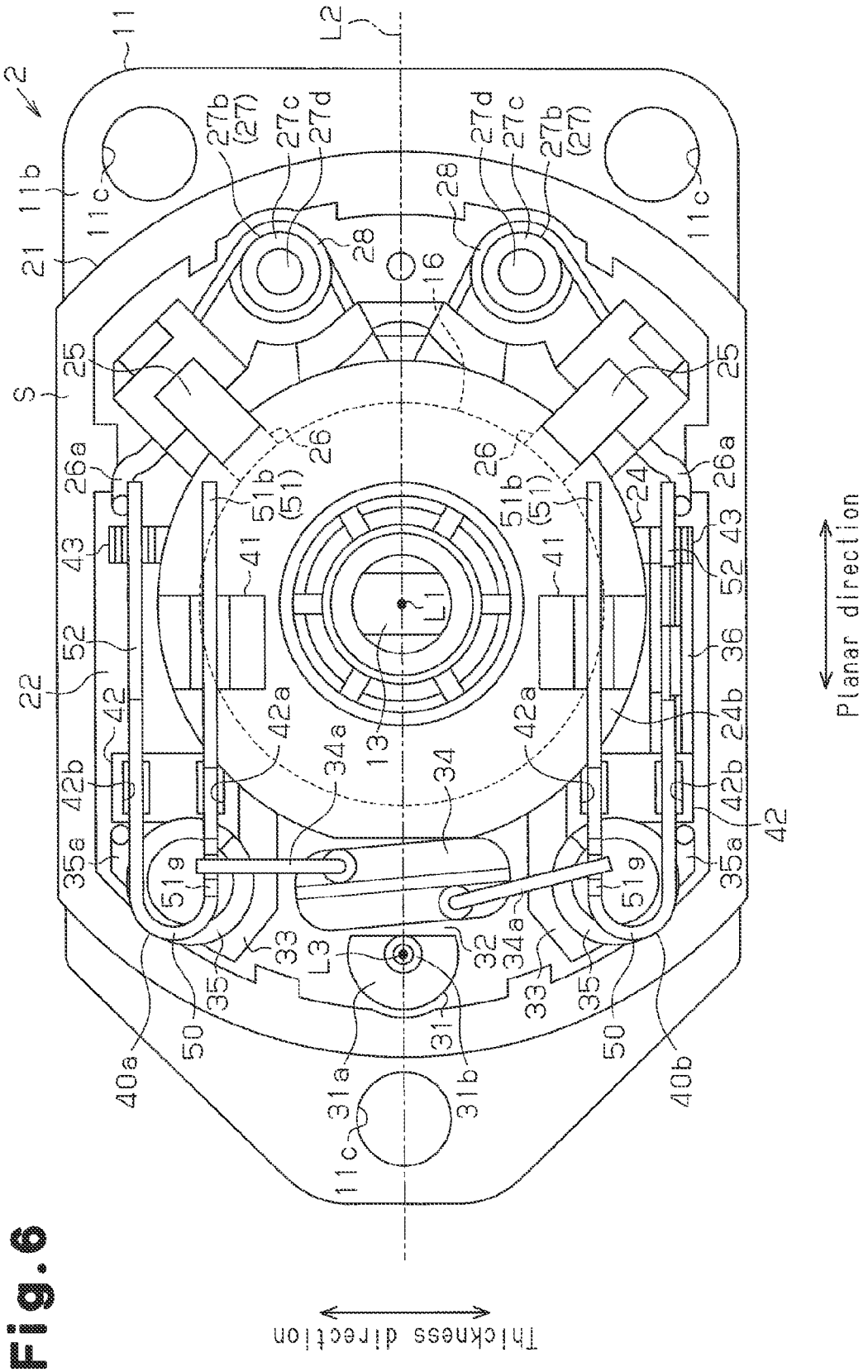
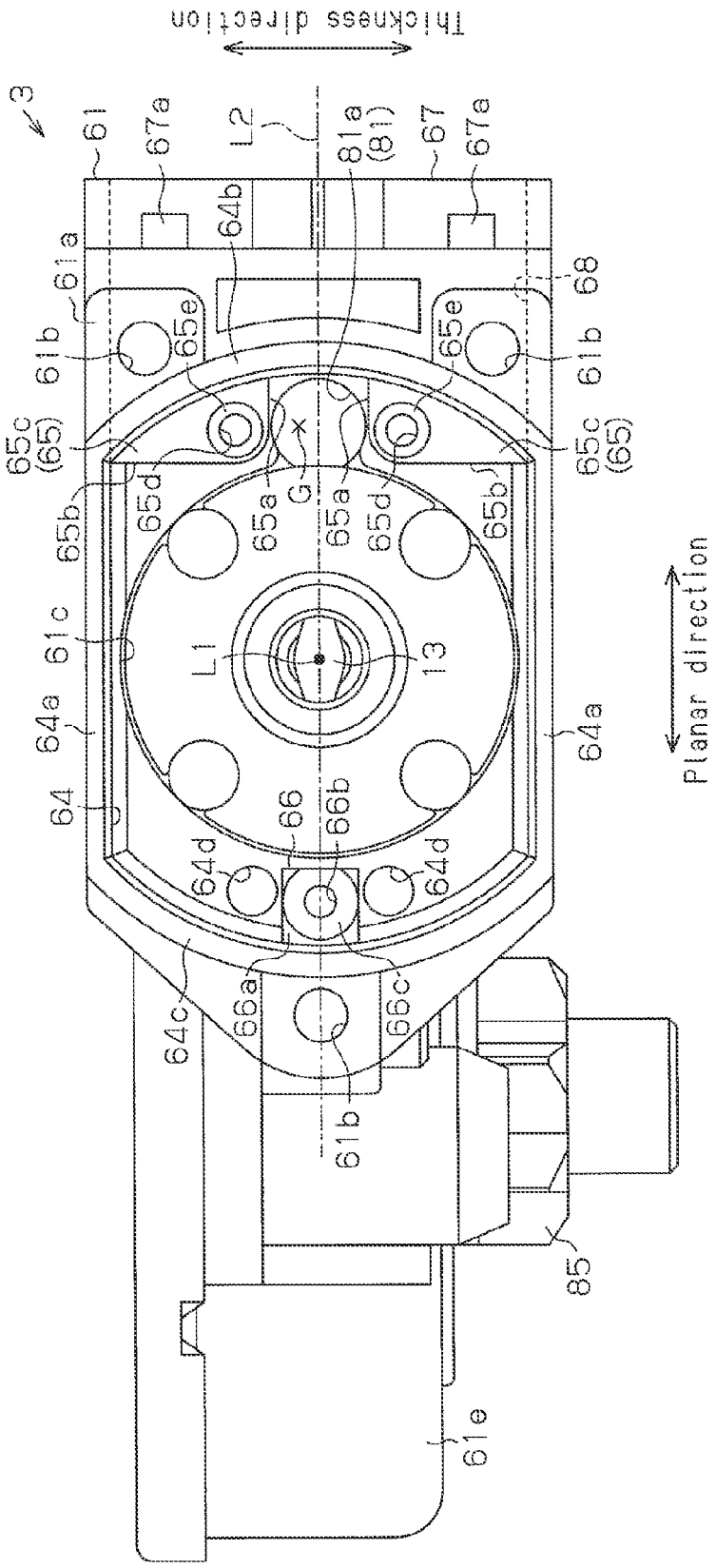


Fig.6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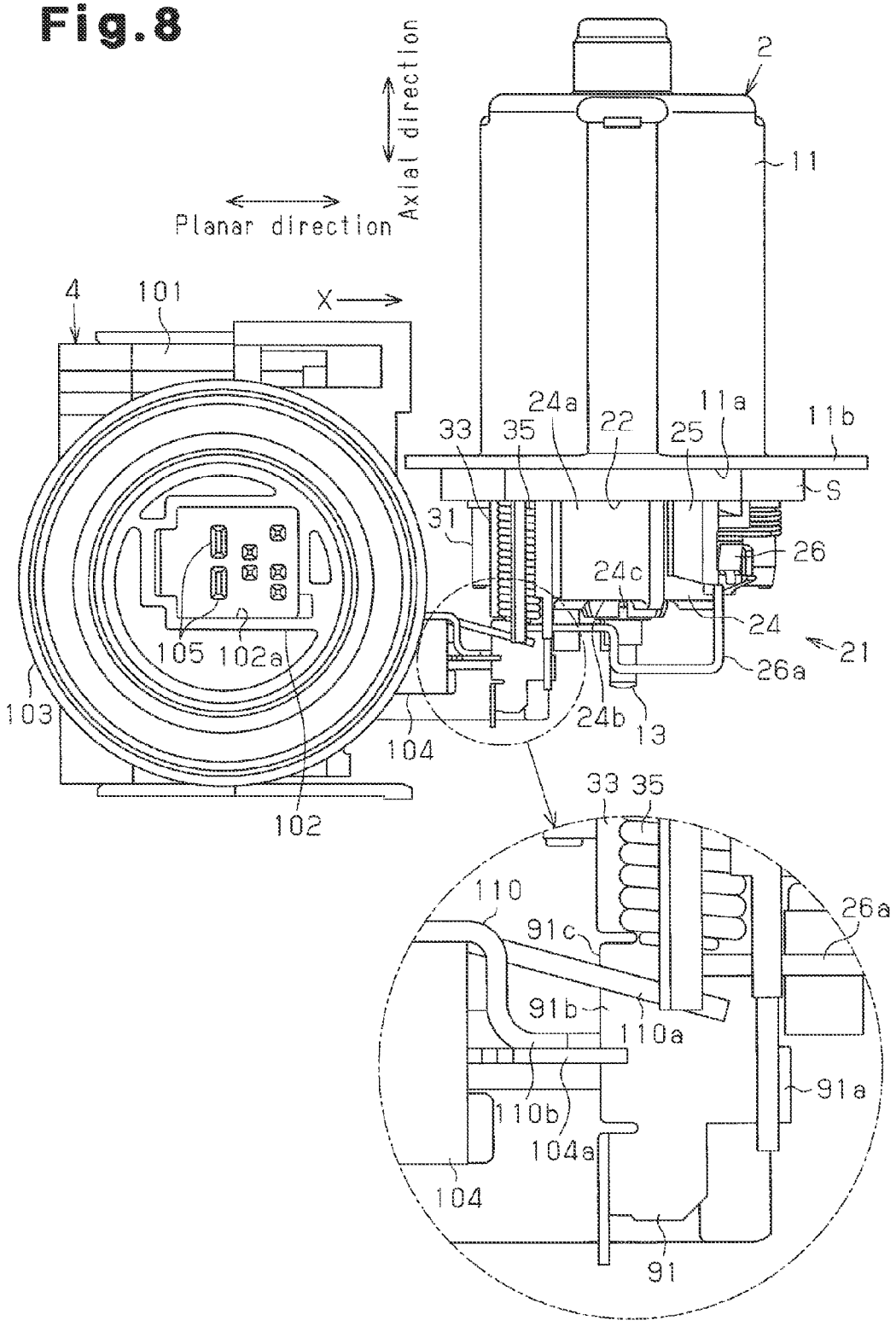
61
67a
L2
81a (81)
67
67a
64b
61a
68
61b
65e
65e
61b
65c (65)
65c (65)
65d
65a
G
65a
65d
65b
65b
61c
L1
13
64a
64a
Planar direction
64
66
66b
64d
64d
64c
66a
66c
61b
85
61e

Fig.7

Fig.8


Axial direction
Planar direction
2
11
4
101
X
24a
22
11a
11b
33
35
25
S
31
26
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21
26a
105
102a
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24b
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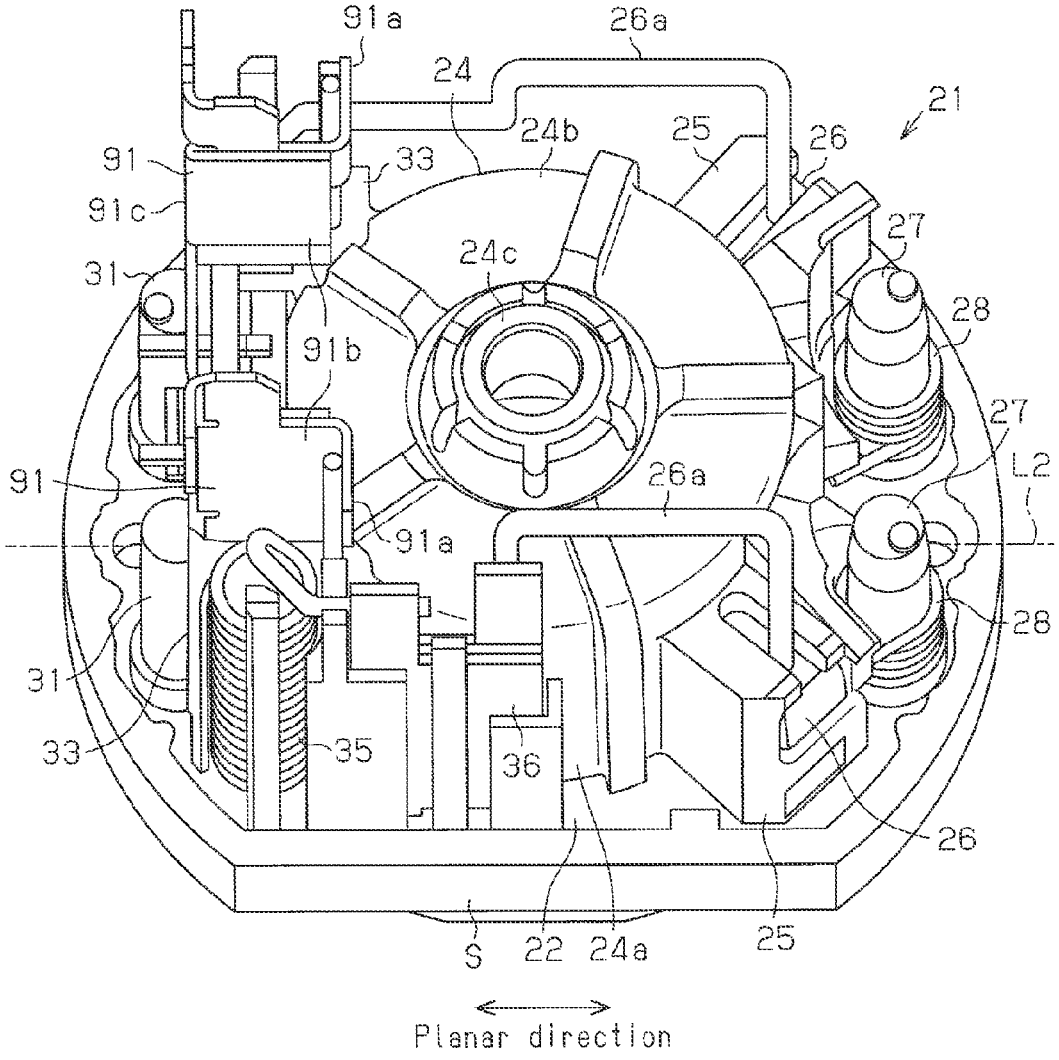
110a
91a
110b
104a
104
91

Fig.9


91a
26a
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21
24b
25
26
91
33
91c
27
24c
31
28
91b
27
91
26a
L2
91a
28
31
33
35
36
26
S
22
24a
25
Planar direction

ELECTRIC MOTOR WITH REDUCED AXIAL FOOTPRINT

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to Japanese Application No. 2010-291608, filed Dec. 28, 2010, and Japanese Application No. 2011-239525, filed Oct. 31, 2011, all of which are herein incorporated by reference in their entirety.

TECHNICAL FIELD

The present invention relates to a motor used as a drive source for a power window device or the like.

BACKGROUND

Japanese National Phase Laid-Open Patent Publication No. 2003-523708 describes a motor for a power window device. The motor includes a motor unit, a deceleration unit, and a connector unit. The motor unit includes a rotor arranged in a yoke housing. The deceleration unit is arranged at an axial end of the motor unit and decelerates rotational drive force of the motor unit. The connector unit is coupled to a gear housing. The yoke housing includes an open end from which a rotation shaft of the rotor projects toward the deceleration unit. A brush holder is arranged in the open end to hold a power supply brush, which supplies power to a commutator of the rotor. The deceleration unit includes a gear housing fixed by screws or the like to the open end. A worm gear, a worm wheel, and the like of a deceleration mechanism are accommodated in the gear housing. The deceleration mechanism decelerates and outputs the rotational drive force of the motor unit. The connector unit is connected to an external connector used to input and output electric signals and supply power. The connector unit includes a connection terminal connected to a conductive member, which is electrically connected to the power supply brush.

The commutator of the motor unit and the power supply brush are arranged outside the yoke housing in the motor of the above publication. Thus, the yoke housing can be easily manufactured at a low cost since the metal yoke housing can have a simple shape to accommodate the brush holder.

Due to the available space in the door of a vehicle, it is desirable that a motor used as a drive source for a power window device be reduced in size in a radial direction that is orthogonal to the axial direction of the motor. However, in the motor of the above publication, the conductive member (printed substrate in the above publication), which is electrically connected to the power supply brush, is arranged beside the commutator in the direction orthogonal to the axial direction. This enlarges the motor in the direction orthogonal to the axial direction.

SUMMARY

It is an object of the present invention to prevent enlargement of the motor in the radial direction when the commutator and the power supply brush are arranged outside the yoke housing.

One aspect of the present invention is a motor including a motor unit that outputs rotational drive force. The motor unit includes a yoke housing having an open end in an axial direction, a commutator, a power supply brush that supplies power to the commutator, a conductive member electrically connected to the power supply brush, and a brush holder arranged in the open end to hold the commutator, the power supply brush, and the conductive member. The motor further includes a deceleration unit and a connector unit. The deceleration unit includes a gear housing coupled to the open end. A deceleration mechanism is arranged in the gear housing to decelerate and output the rotational drive force of the motor unit. The connector unit is coupled to the gear housing and includes a connection terminal electrically connected to the conductive member. The commutator and the power supply brush are arranged outside the yoke housing. The conductive member and the yoke housing are arranged on opposite sides of the commutator.

Other aspects and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

FIG. **1** is a side view showing a motor according to one embodiment of the present invention;

FIG. **2** is an exploded side view showing the motor of FIG. **1**;

FIG. **3** is a cross-sectional view of the motor of FIG. **1**;

FIG. **4** is an enlarged cross-sectional view showing the vicinity of a brush holder in the motor of FIG. **3**;

FIG. **5** is a perspective view showing a motor unit of FIG. **1**;

FIG. **6** is a plan view showing the motor unit of FIG. **1** from an output end;

FIG. **7** is a plan view showing a gear housing of FIG. **1** from the axial direction;

FIG. **8** is a side view showing a modification of the motor unit and the connector unit; and

FIG. **9** is a perspective view showing a modification of the brush holder.

DETAILED DESCRIPTION

One embodiment of the present invention will now be described with reference to the drawings.

A motor **1** of the present embodiment shown in FIG. **1** is used as a drive source for a power window device that electrically raises and lowers a window glass for a vehicle. The motor **1** includes a motor unit **2** located at an upper section of FIG. **1**, a deceleration unit **3** arranged at one end in an axial direction (end from which drive force is output, namely, the output end) of the motor unit **2**, and a connector unit **4** coupled to a side (right side in FIG. **1**) of the deceleration unit **3**. The motor **1**, as a whole, is flat in shape in a direction orthogonal to an axis L**1** (direction orthogonal to plane of FIG. **1**). The description hereafter will be given under the assumption that a longitudinal direction (left and right direction in FIG. **1**) when viewing the motor **1** from the axial direction is a planar direction, and a short side direction (direction orthogonal to plane of FIG. **1**) is a thickness direction. The axial direction, the planar direction, and the thickness direction of the motor **1** are directions that are orthogonal to one another. The axial direction, the radial direction, and the circumferential direction respectively indicate the axial direction, the radial direction, and the circumferential direction of the motor **1** (motor unit **2**).

[Structure of Motor Unit]

As shown in FIGS. **1** to **3**, a yoke housing **11** (hereinafter simply referred to as yoke **11**) of the motor unit **2** has a first end and a second end located on opposite axial sides. The yoke **11** has a tubular shape, in which the first end (end on upper side in FIG. **1**) forms a closed bottom and the second end (output end) forms an open end **11***a*. A flange **11***b* extends outward in the radial direction of the motor **1** at the open end **11***a*.

As shown in FIG. **3**, an armature **14** including a cylindrical rotation shaft **13** is arranged at an inner side of a magnet **12**, which is fixed to an inner circumferential surface of the yoke **11**. The rotation shaft **13** is arranged in the yoke **11** at a central part in the radial direction. A basal end (upper end in FIG. **1**) of the rotation shaft **13** is rotatably supported by a bearing **15** arranged at the bottom center of the yoke **11**. The armature **14** rotates integrally with the rotation shaft **13** about the axis L**1** of the rotation shaft **13**. A distal end of the rotation shaft **13** projects out of the yoke **11** from the open end **11***a*, and a commutator **16** is fixed to the projecting portion of the rotation shaft **13**. In other words, the commutator **16** is arranged outside the yoke **11**. The commutator **16** and the distal end of the rotation shaft **13** are arranged in a resin gear housing **61** that forms the deceleration unit **3**.

[Structure of Brush Holder]

As shown in FIGS. **3** and **4**, a brush holder **21** is arranged in the open end **11***a*. The brush holder **21** includes a planar basal part **22** located outside the open end **11***a* in the axial direction. The basal part **22** is formed so that the size in the direction orthogonal to the axial direction, that is, the radial direction, is slightly greater than the open end **11***a* of the yoke **11**. The basal part **22** has a fixed wall portion **23** extending in the axial direction along the inner circumferential surface of the yoke **11**. The fixed wall portion **23** is inserted from the open end **11***a* into the yoke **11** and fixed thereto. A seal member S made of elastomer is arranged at the outer edge of the basal part **22**. The seal member S has a U-shaped cross-section to sandwich the outer edge of the basal part **22** in the axial direction. The seal member S is axially sandwiched by the flange **11***b* and the gear housing **61**. The seal member S thus seals a space between the open end **11***a* and an opening closer to the yoke **11** of the gear housing **61**. This prevents liquid from entering the yoke **11** and the gear housing **61**.

A cover **24** is formed at the basal part **22**. The cover **24** includes an outer circumferential wall portion **24***a* that axially extends from the lower end face (end face on the side opposite to the end face closer to the yoke **11**) of the basal part **22** and substantially covers the outer periphery of the commutator **16**, and a circular wall portion **24***b* that is formed at an axial end (lower end) of the outer circumferential wall portion **24***a* to cover the axial end face of the commutator **16**. The circular wall portion **24***b* forms the end face on the side opposite to the end face of the cover **24** closer to the yoke **11** in the axial direction. A bearing **24***c* for rotatably supporting the rotation shaft **13** is arranged at the center of the circular wall portion **24***b*. As shown in FIGS. **5** and **6**, two brush accommodation portions **25** extend outward in the radial direction from the outer circumferential wall portion **24***a* of the cover **24** and are spaced about by 90 degrees in the circumferential direction at the lower end face of the basal part **22**. More specifically, as shown in FIG. **6**, the brush accommodation portion **25** is arranged at positions spaced apart by 45 degrees in the circumferential direction from opposite sides of a line L**2** (hereinafter referred to as planar line L**2**) that is orthogonal to the axis L**1** of the rotation shaft **13** and lies along the planar direction of the motor **1**.

As shown in FIGS. **5** and **6**, each brush accommodation portion **25** is box-shaped and opens at opposite sides in the radial direction. In other words, each brush accommodation portion **25** has a hollow shape that communicates the interior and the exterior of the cover **24**. The power supply brush **26**, which is substantially box-shaped, is accommodated in each brush accommodation portion **25** and movable in the radial direction. The distal end (radially inner end) of the power supply brush **26** projects toward the inner circumferential side of the outer circumferential wall portion **24***a* of the cover **24** from the brush accommodation portion **25** and contacts the outer peripheral surface of the commutator **16** in the cover **24**. The cover **24** prevents brush powder, which is produced when the power supply brush **26** slides along the commutator **16**, from falling down.

Two support columns **27**, which project out to the opposite side of the yoke **11** in the axial direction from the lower end face of the basal part **22**, are formed between the two brush accommodation portions **25** in the circumferential direction. The brush accommodation portions **25** and the support column **27** are collectively arranged on one side in the planar direction with respect to the axis L**1** of the rotation shaft **13** and are formed to be line symmetric with respect to the planar line L**2**.

Each support column **27** has a circular cross-section and includes a basal end defining a large diameter portion **27***a*. A support portion **27***b* axially extends from the large diameter portion **27***a*. A coil portion of a torsion spring **28** serving as a bias member is fitted to and held on the support portion **27***b*. The large diameter portion **27***a* has a larger diameter than the support portion **27***b*. In other words, the location where the support portion **27***b* shifts to the large diameter portion **27***a* forms a step that axially positions the torsion spring **28**.

A distal end **27***c* (axial end) of the support column **27** has a planar shape and is orthogonal to the axis L**1**. A first positioning projection **27***d* (positioning portion closer to gear housing) projects in the axial direction from the center of the distal end **27***c*. The positioning projection **27***d* is cylindrical and has a smaller diameter than the support column **27**. The positioning projection **27***d* and the support column **27** are coaxial. A step is formed between the positioning projection **27***d* and the support column **27**.

One end of the torsion spring **28** supported by the support column **27** is held by the outer circumferential wall portion **24***a* of the cover **24**. The other end of the torsion spring **28** is radially brought into contact with the basal end of the power supply brush **26** to push the power supply brush **26** inward in the radial direction. This biases the power supply brush **26** inward in the radial direction, and the distal end of the power supply brush **26** comes into contact under pressure with the outer peripheral surface of the commutator **16** in the cover **24**.

A projecting column **31** that projects opposite to the yoke in the axial direction from the lower end face of the basal part **22** is formed at a side in the planar direction of the cover **24** or a part on the side opposite to the part where the brush accommodation portion **25** and the support column **27** are arranged. The projecting column **31** has a D-shaped cross-section in which the side surface closer to the cover **24** in the planar direction is partially cut out. The projecting column **31** is arranged next to the rotation shaft **13** in the planar direction. An axis L**3** of the projecting column **31** is parallel to the axis L**1** of the rotation shaft **13** and orthogonal to the planar line L**2**. In other words, the two support columns **27**, the two brush accommodation portions **25**, and the two power supply brushes **26** are line symmetric with respect to a line (planar line L**2** in the present embodiment) extending through the

axis L3 of the projecting column **31** and the axis L1 of the rotation shaft **13** as viewed in the axial direction.

A distal end **31***a* of the projecting column **31** has a planar shape and is orthogonal to the axis L1. A second positioning projection **31***b* (positioning portion closer to projecting column) projects in the axial direction from the center of the distal end **31***a*. The positioning projection **31***b* is cylindrical and has a smaller diameter than the projecting column **31**. The positioning projection **31***b* and the projecting column **31** are coaxial. A step is formed between the positioning projection **31***b* and the projecting column **31**.

A holding wall portion **33** forming part of a capacitor accommodation portion **32** is arranged upright on opposite sides of the projecting column **31** in the circumferential direction. A capacitor **34** serving as an electrical component is coupled from the side opposite to the yoke **11** in the axial direction in the capacitor accommodation portion **32**, which is formed by each holding wall portion **33**, the projecting column **31**, and the cover **24**. A choke coil **35** serving as an electrical component is held on the side opposite to the capacitor **34** of each holding wall portion **33**. Each choke coil **35** is arranged so that its axis is parallel to the axis L1 of the motor unit **2**. The two holding wall portions **33** and the two choke coils **35** are respectively configured to be line symmetric with respect to the planar line L2.

Two terminals **40***a*, **40***b* (conductive member) are arranged at positions on the side opposite to the yoke **11** in the axial direction with respect to the cover **24**. The brush holder **21** includes first to third terminal holders **41** to **43** for each of the two terminals **40***a*, **40***b*. Each of the two first to third terminals holders **41** to **43** and the two terminals **40***a*, **40***b* are respectively configured to be line symmetric with respect to the planar line L2 of the motor **1**.

The two first terminal holders **41** extend in an axial direction from a circular wall portion **24***b* and sandwich the rotation shaft **13** of the motor **1** in the thickness direction that. Each first terminal holder **41** is bifurcated to sandwiching the planar terminals **40***a*, **40***b* in the plate thickness direction. Each second terminal holder **42** is arranged upright at the lower end face of the basal part **22** closer to the cover **24** with respect to each choke coil **35** in the planar direction. First and second fixing recesses **42***a*, **42***b* are arranged in the thickness direction of the motor **1** at the distal end face in the axial direction of each second terminal holder **42**. The fixing recess positioned on the inner side in the thickness direction of the motor **1** of the first and second fixing recesses **42***a*, **42***b* is the first fixing recess **42***a* and that on the outer side is the second fixing recess **42***b*. Each third terminal holder **43** is arranged at positions adjacent in the circumferential direction with each of the two brush accommodation portions **25**, the position being on the side opposite to the support column **27**. The third terminal holder **43** is formed extending in the axial direction from the lower end face of the basal part **22**. The distal end in the axial direction of the third terminal holder **43** is bifurcated to sandwich the planar terminals **40***a*, **40***b* in the plate thickness direction in the same manner as the first terminal holder **41**.

Each terminal **40***a*, **40***b* is formed by pressing and punching a conductive metal plate material to a predetermined shape and then bending a plurality of locations. Each terminal **40***a*, **40***b* is U-shaped as viewed in the axial direction and arranged so that the distal end of the U-shape is directed in the planar direction of the motor **1**. The terminals **40***a*, **40***b* are respectively arranged on opposite sides of the rotation shaft **13** in the thickness direction of the motor **1**. In other words, the rotation shaft **13** is inserted between the terminals **40***a*, **40***b* arranged parallel to the thickness direction. The terminals **40***a*, **40***b* are arranged so that their planar surfaces are parallel to the axis L1 of the rotation shaft **13**. The first to third terminal holders **41** to **43** are each configured so that the terminals **40***a*, **40***b* are coupled from the opposite side of the yoke **11** with respect to the first to third terminal holders **41** to **43** in the axial direction.

Each of the terminals **40***a*, **40***b* includes a bent portion **50**, which serves as an intermediate portion, a first terminal portion **51**, and a second terminal portion **52**, and is configured to be U-shaped when viewed in the axial direction. The bent portion **50** is positioned on the side opposite to the yoke **11** in the axial direction with respect to the choke coil **35**. The first terminal portion **51** and the second terminal portion **52** are configured so that the first and second terminal portions **51**, **52** linearly extending in the planar direction from the bent portion **50** in the axial direction are arranged parallel to the thickness direction (direction orthogonal to the axis) of the motor **1** and are faced in the same direction (planar direction or direction opposing the inserting direction of a connection terminal **72***a*, which will be described later). The first terminal portion **51** axially overlaps the circular wall portion **24***b* and the commutator **16**, and the second terminal portion **52** is arranged at a position that does not axially overlap the cover **24**.

The first terminal portion **51** has the shape of a tuning fork, which is bifurcated into two in the axial direction, and has opens toward the planar direction when viewed from the thickness direction of the motor **1**. Specifically, the first terminal portion **51** is bifurcated and includes first and second extending portions **51***b*, **51***c* extending from a basal end **51***a* in the planar direction (direction opposing the inserting direction of the connection terminal **72***a*). The first and second extending portions **51***b*, **51***c* are arranged in the axial direction. Contacting projections **51***d* project toward each other from distal ends of each extending portion **51***b*, **51***c*.

The first and second extending portions **51***b*, **51***c* are sandwiched in the thickness direction of the motor **1** by the first terminal holder **41**. In other words, the first terminal holder **41** holds the part of the bifurcated section closer to the distal end than the basal end **51***a*, which is divided into two at the bifurcated section. The second extending portion **51***c*, which is closer to the yoke **11** of the two extending portions **51***b*, **51***c*, includes a hooking projection (hook) **51***e* that projects towards the cover **24** in the axial direction. The hooking projection **51***e* can be brought into contact with respect to the first terminal holder **41** in the planar direction (inserting direction of the connection terminal **72***a*) of the motor **1**.

A projection **51***f* that projects towards the cover **24** in the axial direction is formed at a part corresponding to the second terminal holder **42** in the first terminal portion **51** (see FIG. **4**). The first terminal portion **51** is held by the second terminal holder **42** when the projection **51***f* is fitted to the first fixing recess **42***a* of the second terminal holder **42**. A similar projection **52***a* is also formed on the second terminal portion **52** (see FIG. **5**). The second terminal portion **52** is held by the second terminal holder **42** when the projection **52***a* is fitted to the second fixing recess **42***b* of the second terminal holder **42**. Movement in the planar direction of the terminals **40***a*, **40***b* is restricted by the fitting of the projection **51***f* to the first fixing recess **42***a* and the fitting of the projection **52***a* to the second fixing recess **42***b*. The second terminal portion **52** is sandwiched in the thickness direction of the motor **1** by the distal end in the axial direction of the third terminal holder **43**.

In this manner, in each terminal **40***a*, **40***b* held at the brush holder **21**, a pigtail **26***a* serving as a conductive wire extending from the nearest power supply brush **26** is welded to the end in the planar direction of the motor **1** in the second

terminal portion **52**. This electrically connects the second terminal portion **52** to the power supply brush **26** through the pigtail **26***a*.

Each of two connection ends **34***a* extending from the capacitor **34** is welded and electrically connected to a connecting portion **51***g* formed at the basal end **51***a* (boundary portion of first terminal portion **51** and bent portion **50**) of the first terminal portion **51** of the terminal **40***a*, **40***b*. The connection end **35***a* of each choke coil **35** is welded and electrically connected to the second terminal portion **52** of the nearest terminal **40***a*, **40***b*. A thermistor **36** arranged outside the second terminal portion **52** in the thickness direction is electrically connected to the second terminal portion **52** of one terminal **40***b* (terminal on lower side in FIG. **6**).

[Structure of Deceleration Unit]

As shown in FIG. **3**, the deceleration unit **3** includes the gear housing **61** and a deceleration mechanism **62** accommodated in the gear housing **61**.

As shown in FIG. **7**, three threaded holes **61***b* are formed in an end face **61***a* closer to the yoke **11** of the gear housing **61**. The end face **61***a* is brought into contact with the flange **11***b* of the yoke **11** in the axial direction and is fixed to the flange **11***b* by three screws **63** (only two are shown in FIGS. **1** to **4**). The three screws **63** are fastened to the threaded holes **61***b* through corresponding screw insertion holes **11***c* (see FIG. **6**) formed in the flange **11***b*.

A holder accommodation portion **64** open towards the yoke **11** in the axial direction is formed inward in the radial direction from the three threaded holes **61***b* at the end face **61***a* closer to the yoke **11** of the gear housing **61**. The commutator **16**, the rotation shaft **13**, and part of the brush holder **21** of the motor unit **2** are arranged in the holder accommodation portion **64**.

The holder accommodation portion **64** includes two opposing wall portions **64***a*, which face each other in the thickness direction of the motor **1**, and two opposing wall portions **64***b*, **64***c*, which face each other in the planar direction of the motor **1**. As viewed in the axial direction, each opposing wall portion **64***a* has a linear shape in the planar direction, and each opposing wall portion **64***b*, **64***c* has a curved shape bulging outward in the radial direction.

As shown in FIGS. **2**, **3**, and **7**, one of the opposing wall portions (opposing wall portion **64***b* closer to connector unit **4**) in the planar direction includes two projecting wall portions **65** positioned at the inner side of the holder accommodation portion **64** and projected outward in a direction orthogonal to the axial direction. Each projecting wall portion **65** is formed to be line symmetric with respect to the planar line L**2**. Each projecting wall portion **65** has a first end face **65***a*, which has a planar shape orthogonal to the thickness direction of the motor **1**, and a second end face **65***b*, which is orthogonal to the first end face **65***a*. An end face (axial end face **65***c*) of each projecting wall portion **65** closer to the yoke **11** in the axial direction has a planar shape orthogonal to the axis L**1**. The axial end faces **65***c* of the two projecting wall portions **65** are positioned on the same plane.

The first end faces **65***a* of the two projecting wall portions **65** face each other in the thickness direction. A circular first positioning recess **65***d* is arranged in a recessed manner at the axial end face **65***c* of the two projecting wall portions **65**. The two first positioning projections **27***d* of the brush holder **21** are fitted into the positioning recesses **65***d*. A projection **66** projecting inward in the radial direction from the central part in the thickness direction of the opposing wall portion **64***c* on the side opposite to the opposing wall portion **64***b* where the projecting wall portion **65** is arranged. The end face **66***a* closer to the yoke **11** of the projection **66** in the axial direction is positioned on the same plane as the axial end face **65***c* of the projecting wall portion **65**. A circular second positioning recess **66***b* is arranged in a recessed manner at the end face **66***a*. The second positioning projection **31***b* of the brush holder **21** is fitted into such positioning recess **66***b*. As described above, the brush holder **21** and the gear housing **61** are positioned in the direction orthogonal to the axial direction when the first positioning projection **27***d* and the second positioning projection **31***b* of the brush holder **21** are fitted to the first positioning recess **65***d* and the second positioning recess **66***b* of the gear housing **61**.

As shown in FIG. **7**, the axial end face **65***c* of each projecting wall portion **65** includes a reference surface **65***e* formed by raising the circumferential part of the first positioning recess **65***d*. The axial end face **66***a* of the projection **66** is also formed with a reference surface **66***c* formed by raising the circumferential part of the second positioning recess **66***b*. Each reference surface **65***e*, **66***c* has a planar shape and is positioned on the same plane orthogonal to the axis L**1** of the rotation shaft **13**. The reference surface **65***e* is axially brought into contact with the distal end **27***c* of the corresponding support column **27** and the reference surface **66***c* is axially brought into contact with the distal end **31***a* of the projecting column **31**, so that the brush holder **21** is positioned in the axial direction. The projecting amount of each reference surface **65***e*, **66***c* in the axial direction is very small and thus not shown in FIGS. **2** and **3**. Each reference surface **65***e*, **66***c* is locally formed. This facilitates examination of the axial position and the planarity of each reference surface **65***e*, **66***c* and the adjustment for arranging the reference surfaces **65***e*, **66***c* on the same plane.

As shown in FIGS. **2**, **3**, and **7**, a connector attachment portion **67** is formed on a side surface (right side in FIGS. **2**, **3**, and **7**) of the gear housing **61** on the side opposite to the side surface closer to a wheel accommodating portion **61***e* in the planar direction. The connector unit **4** is coupled, in a removable manner, to the connector attachment portion **67** from the planar direction. The connector attachment portion **67** includes a socket **68** that opens towards the direction opposite to the direction towards the wheel accommodating portion **61***e* in the planar direction. The wall portion closer to the motor unit **2** of the socket **68** is configured by the projecting wall portion **65**. The socket **68** is in communication with the holder accommodation portion **64** inside the gear housing **61**. In other words, the holder accommodation portion **64** is in communication with the exterior of the gear housing **61** through the socket **68**. The socket **68** has a square shape when viewed from the open direction.

As shown in FIGS. **2** and **3**, the connector unit **4** includes a fixed portion **71** fixed to the connector attachment portion **67**, a control IC **72** inserted into the socket **68**, and an external connecting portion **73** to which an external connector (not shown) for inputting and outputting electric signals and power supply is connected. The fixed portion **71** is fixed to the connector attachment portion **67** by engaging two hooking pieces **71***a* to hooking projection **67***a* formed at opposite ends in the axial direction of the connector attachment portion **67**. The space between the connector attachment portion **67** and the fixed portion **71** of the connector unit **4** is sealed to prevent liquid from entering.

The box-shaped control IC **72** having a solid rectangular shape is arranged at the fixed portion **71** to extend in the planar direction of the motor **1**. A flat connection terminal **72***a* is arranged at the distal end (end in planar direction) of the control IC **72** to project in the planar direction of the motor **1**. Two connection terminals **72***a* are arranged in the thickness direction of the motor **1** (only one shown in FIGS. **2** to **4**). The

control IC **72** is inserted in the planar direction to the socket **68** of the connector attachment portion **67**. The two connection terminals **72***a* of the control IC **72** are respectively press-fitted between the first and second extending portions **51***b*, **51***c* of the two terminals **40***a*, **40***b* inside the holder accommodation portion **64**. The inserting direction of the connection terminal **72***a* between the first and second extending portions **51***b*, **51***c* coincides with the coupling direction of the connector unit **4** and the gear housing **61**. Each connection terminal **72***a* is thus elastically sandwiched by the first and second extending portions **51***b*, **51***c* in the axial direction and electrically connected to the terminals **40***a*, **40***b*. Further, an opening **73***a* (see FIG. **3**) is formed in the external connecting portion **73** of the connector unit **4**, and an exterior side connection terminal **73***b* electrically connected to the control IC **72** is arranged in the opening **73***a*. The exterior side connection terminal **73***b* is electrically connected to the external connector attached to the external connecting portion **73**.

A circulation hole **81** is formed in the gear housing **61**. An interior side opening **81***a* shown in FIG. **7** is formed in a wall portion **68***a* positioned on the opposite side in the axial direction from the wall portion facing the motor unit **2** of the wall portions defining the socket **68**. The circulation hole **81** is in communication with the interior side opening **81***a* and is open to the exterior. The interior side opening **81***a* is formed at a position axially overlapping a gap G between the projecting wall portions **65** arranged in the thickness direction of the motor **1**. This suppresses enlargement of the gear housing **61** in the radial direction while enabling a slide mold (not shown) for molding the interior side opening **81***a* to be axially removed from the gap G when molding the gear housing **61**.

The circulation hole **81** prevents force from locally concentrating at a seal portion (e.g. seal member S), which seals the gear housing **61**, so that a pressure difference is not produced between the outer side and inner side of the gear housing **61**. The circulation hole **81** includes a waterproof sheet (not shown) that prevents water from entering the gear housing **61** while circulating air between the interior and exterior of the gear housing **61**. The holder accommodation portion **64** and the wheel accommodating portion **61***e*, which will be described later, are respectively formed on opposite sides of the projection **66** in the circumferential direction and are in communication with a communication hole **64***d*, which extends in the axial direction.

The holder accommodation portion **64** communicates a clutch accommodating portion **61***c*, which is located at a lower side (opposite side of yoke **11**) of the holder accommodation portion **64** in the axial direction, with a worm accommodating portion **61***d*, which is located at a further lower side of the clutch accommodating portion **61***c* in the axial direction. A worm shaft **82** is supported by the worm accommodating portion **61***d* rotatably about the axis L1. The worm shaft **82** and the rotation shaft **13** are coupled by a clutch **83** accommodated in the clutch accommodating portion **61***c*. The clutch **83** transmits the rotational force of the rotation shaft **13** to the worm shaft **82** and functions to generate a braking force that restricts rotation when the rotational force from the worm shaft **82** is input. The clutch **83** is configured so that the coupling portion between the clutch **83** and the rotation shaft **13** is located between the terminals **40***a*, **40***b* in the brush holder **21**. This suppresses enlargement of the motor **1** in the axial direction.

The wheel accommodating portion **61***e* is in communication with the worm accommodating portion **61***d* and accommodates a circular plate-shaped worm wheel **84**, which is engaged with the worm shaft **82**, next to the worm accommodating portion **61***d* in the direction orthogonal to the axial direction. The worm wheel **84** is supported by the worm accommodating portion **61***d* rotatably about an axis parallel to the thickness direction of the motor **1**. The worm shaft **82** and the worm wheel **84** configure the deceleration mechanism **62**. The rotational force of the rotation shaft **13** is decelerated by the worm shaft **82** and the worm wheel **84** and output from the output shaft **85** shown in FIG. **1** that integrally rotates with the worm wheel **84**. The output shaft **85** projects out of the gear housing **61** and is coupled to a window glass of a vehicle coupled by a window regulator (not shown).

The operation of the embodiment described above will now be described.

The power supplied from the external connector attached to the connector unit **4** is supplied from the connection terminal **72***a* of the control IC **72** to the commutator **16** of the armature **14** through the terminals **40***a*, **40***b* and the power supply brushes **26**. The armature **14** (rotation shaft **13**) is then rotated and driven. The rotational drive force of the rotation shaft **13** is transmitted to the worm shaft **82** by the clutch **83**, decelerated by the worm shaft **82** and the worm wheel **84**, and output from the output shaft **85**. The window glass is then lowered or raised by the window regulator coupled to the output shaft **85** in accordance with the rotating direction of the output shaft **85**.

In this structure, the terminals **40***a*, **40***b* are held by the brush holder **21** so that the terminals **40***a*, **40***b* and the yoke **11** are arranged at opposite sides of the commutator **16**. Further, at least parts of the terminals **40***a*, **40***b* axially overlap the commutator **16**. This suppresses enlargement of the motor **1** in the radial direction. Each of the terminals **40***a*, **40***b* includes the first and second terminal portions **51**, **52** extending parallel to the direction (flat direction) orthogonal to the axial direction and facing the same direction. The bent portion **50** connects the first and second terminal portions **51**, **52** and is substantially U-shaped. The connection terminal **72***a* of the connector unit **4** and the power supply brush **26** are arranged in the vicinity of the first terminal portion **51** and second terminal portion **52** of each of the terminals **40***a*, **40***b*. Various types of electric components (capacitor **34** and choke coil **35**) connected to the terminals **40***a*, **40***b* are arranged in the vicinity portions connected to the terminals **40***a*, **40***b* (e.g., connecting portion **51***g*). Since the members connected to each other are arranged near each other, the members can be easily connected. Further, enlargement of the motor **1** in the radial direction is suppressed since each of the power supply brush **26**, the capacitor **34**, the choke coil **35**, and the connection terminal **72***a* of the connector unit **4** do not need to be arranged parallel to the direction orthogonal to the axial direction.

In the motor **1** described above, the first positioning projection **27***d* of each support column **27** and the second positioning projection **31***b* of the projecting column **31** are respectively fitted to the first positioning recess **65***d* of each projecting wall portion **65** and the second positioning recess **66***b* of the projection **66** of the gear housing **61** when coupling the motor unit **2** to the gear housing **61**. This positions the brush holder **21** and the gear housing **61** in the direction orthogonal to the axial direction. The projecting wall portion **65** also functions to receive brush powder dropped from the vicinity of the brush holder **21**.

The distal end **27***c* and the distal end **31***a* are respectively brought into contact in the axial direction with the axial end face **65***c* (specifically, reference surface **65***e*) and the axial end face **66***a* (specifically, reference surface **66***c*). This positions the brush holder **21** in the axial direction and restricts movement of the brush holder **21** in the axial direction thereby stably supporting the brush holder **21**.

The first positioning projection **27***d* is arranged at the distal end **27***c* of the support column **27**. Thus, the brush holder **21** does not need to be enlarged in the direction orthogonal to the axial direction to provide space for the positioning projection **27***d*. This prevents enlargement in the radial direction while arranging the positioning projection **27***d* in the brush holder **21**.

The control IC **72** of the connector unit **4** is inserted into the socket **68** of the gear housing **61**. The first positioning recess **65***d* is formed on the axial end face **65***c* on the side opposite to the end face closer to the control IC **72** in the projecting wall portion **65** configuring the socket **68**. Thus, the brush holder **21** and the gear housing **61** are positioned in the direction orthogonal to the axial direction at the part of the gear housing **61** closer to the motor unit **2** than the control IC **72** inserted to the socket **68**. This prevents interference between the first positioning projection **27***d*, which is closer to the brush holder **21**, and the control IC **72**.

The present embodiment has the advantages described below.

(1) In the present embodiment, the yoke housing has an open end at one end in the axial direction. The brush holder **21** is arranged in the open end. The commutator **16** and the power supply brush **26** are arranged outside the yoke **11**. The terminals **40***a*, **40***b* and the yoke **11** are arranged at opposite sides of the commutator **16**. This suppresses enlargement of the motor **1** in the radial direction. The terminals **40***a*, **40***b* at least partially overlap the commutator **16** in the axial direction and suppress enlargement of the motor **1** in the radial direction.

(2) In the present embodiment, the brush holder **21** includes first to third terminal holders **41** to **43** for holding the terminals **40***a*, **40***b*. The first to third terminal holders **41** to **43** are configured so that the terminals **40***a*, **40***b* are coupled from the opposite side of the yoke **11** with respect to the first to third terminal holders **41** to **43** in the axial direction. The terminals **40***a*, **40***b* are thus coupled to the brush holder **21** from the opposite side of the yoke **11** in the axial direction. This improves the assembling efficiency of the motor **1** in which the commutator **16** and the power supply brush **26** are arranged outside the yoke **11**.

(3) In the present embodiment, the commutator **16** includes a first end face facing the yoke **11** and an opposite second end face. The brush holder **21** includes the cover **24** for covering the second end face of the commutator **16**. Since the cover **24** covers the end face on the side opposite to the end face facing the yoke **11** in the axial direction, brush powder is not scattered when the power supply brush **26** slides along the commutator **16**. Further, the two first terminal holders **41** for holding the terminals **40***a*, **40***b* are arranged in the cover **24**. This easily arranges the terminals **40***a*, **40***b* to sandwich opposite sides of the yoke **11** with respect the commutator **16** in a state at least partially overlapping the commutator **16** in the axial direction.

(4) In the present embodiment, the terminals **40***a*, **40***b* include a first terminal portion **51** having the elastic bifurcated section. The connection terminal **72***a* of the connector unit **4** is inserted into the bifurcated section of the first terminal portion **51** (between the first and second extending portions **51***b*, **51***c*) to be elastically sandwiched by the bifurcated section. Thus, the connection terminal **72***a* of the connector unit **4** and the terminals **40***a*, **40***b* are easily connected without the need for welding or the like.

(5) In the present embodiment, the bifurcated section includes the basal end **51***a* that is divided into two. The brush holder **21** includes the first terminal holder **41** that holds the part of the bifurcated section closer to the distal end than the basal end **51***a*. This holds the bifurcated section of the first terminal portion **51** sandwiching the connection terminal **72***a* in position and suppresses vibration of the bifurcated section (first and second extending portions **51***b*, **51***c*) of the first terminal portion **51**. As a result, the connection stability of the terminal **40***a*, **40***b* and the connection terminal **72***a* is improved.

(6) In the present embodiment, the connector unit is coupled to the gear housing along the predetermined coupling direction. The terminals **40***a*, **40***b* include the hooking projection **51***e* that is contactable with the brush holder **21** in the coupling direction. The hooking projection **51***e* restricts movement of the terminal **40***a*, **40***b* in the connecting direction of the connection terminal **72***a*. Thus, when the connection terminal **72***a* is connected to the terminal **40***a*, **40***b*, the movement of the terminal **40***a*, **40***b* in the connecting direction is suppressed. As a result, connection of the terminal **40***a*, **40***b* and the connection terminal **72***a* is ensured.

(7) In the present embodiment, the terminals **40***a*, **40***b* are planar and have a planar surface parallel to the axis L**1** of the motor unit **2**. Thus, the terminals **40***a*, **40***b* are reduced in size in the direction orthogonal to the axial direction. As a result, enlargement of the motor **1** in the radial direction is prevented in a preferable manner.

(8) In the present embodiment, each of the terminals **40***a*, **40***b* held by the brush holder **21** is substantially U-shaped and includes the first and second terminal portions **51**, **52**, which extend parallel to the direction (flat direction) orthogonal to the axial direction and face the same direction, and the bent portion **50** connecting the first and second terminal portions **51**, **52**. The connection terminal **72***a* of the connector unit **4** is connected to the first terminal portion **51**, and the pigtail **26***a* extending from the power supply brush **26** is connected to the second terminal portion **52**. Thus, the connection terminal **72***a* of the connector unit **4** and the power supply brush **26** may be respectively arranged in the vicinity of the first terminal portion **51** and the second terminal portion **52** of each terminal **40***a*, **40***b*. Further, various types of electric components (capacitor **34** and choke coil **35**) connected to the terminals **40***a*, **40***b* may be arranged in the vicinity of portions connected to the terminals **40***a*, **40***b* (e.g., connecting portion **51***g*). The members are easily connected by arranging the members close to each other. Further, the enlargement of the motor **1** in the radial direction is suppressed since each of the power supply brush **26**, the capacitor **34**, the choke coil **35**, and the connection terminal **72***a* of the connector unit **4** do not need to be arranged in the direction parallel to the direction orthogonal to the axial direction.

(9) In the present embodiment, the first and second terminal portions **51**, **52** of the terminal **40***a*, **40***b* are arranged parallel to the direction orthogonal to the axial direction of the motor unit **2**. Thus, the terminals **40***a*, **40***b* are substantially U-shaped when viewed from the axial direction. This suppresses enlargement of the motor **1** in the radial direction in a preferable manner while facilitating connection of the power supply brush **26**, the capacitor **34**, the choke coil **35**, and the connection terminal **72***a* to the terminals **40***a*, **40***b*.

It should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit or scope of the invention. Particularly, it should be understood that the present invention may be embodied in the following forms.

In the embodiment described above, the terminals **40***a*, **40***b* are substantially U-shaped as viewed from the axial direction but may be, for example, substantially U-shape as viewed from a direction orthogonal to the axial direction. In other words, the terminals **40***a*, **40***b* may be configured so that the first and second terminal portions **51**, **52** are arranged parallel

to the axial direction of the motor unit **2**. The terminals **40***a*, **40***b* may be linear when viewed from the axial direction.

In the embodiment described above, the first terminal portion **51** has the shape of a tuning fork in each of the terminals **40***a*, **40***b* but is not particularly limited in such a manner. The shape of the first terminal portion **51** and the structure connecting the connection terminal **72***a* may be changed in accordance with the specification.

In the embodiment described above, the terminals **40***a*, **40***b* are arranged so that the planar surface is parallel to the axis L**1** of the motor unit **2** but may be arranged so that the planar surface is orthogonal to the axis L**1**, for example.

In the embodiment described above, the arrangement and shape of the first to third terminal holders **41** to **43** and the structure holding each of the terminals **40***a*, **40***b* may be changed in accordance with the specification. For instance, each of the first to third terminal holders **41** to **43** may be arranged on the cover **24**.

In the embodiment described above, the control IC **72** of the connector unit **4** is inserted into the socket **68** but not particularly limited in such a manner. The structure of a portion inserted into the socket **68** in the connector unit **4** may be changed in accordance with the specification. Further, the connector unit does not have to include the control IC **72** and may include a connection terminal connected to the terminal **40***a*, **40***b*.

In the embodiment described above, the torsion spring **28** is used as a bias member for pushing the power supply brush **26**. Other springs may be used instead.

In the embodiment described above, the deceleration mechanism **62** includes the worm shaft **82** and the worm wheel **84** but is not particularly limited in such a manner and may include a flat gear or the like.

In the embodiment described above, the present invention is applied to the motor **1** used in the drive source of the power window device but is not particularly limited in such a manner and may be applied to a motor used as a drive source for a device other than the power window device.

In the embodiment described above, each terminal (terminals **40***a* and **40***b*) arranged in the brush holder **21** has the shape of a tuning fork, and the terminal (connection terminal **72***a*) arranged in the connector unit **4** is inserted into the turning fork shaped terminal. Instead, the terminal arranged in the connector unit **4** may have the shape of a tuning fork, and the terminal arranged in the brush holder **21** may be the inserting terminal.

In a structure shown in FIGS. **8** and **9**, two terminals **91** serving as conductive members are held at the two holding wall portions **33** of the brush holder **21**, respectively. Each terminal **91** sandwiches opposite sides of the yoke **11** in the axial direction with the commutator **16** (cover **24**) and is configured to be line symmetric with respect to the planar line L**2**.

Each of the two terminals **91** is formed from a single metal plate and includes a connecting piece **91***a*, which is connected to a terminal extending from the choke coil **35**, and an inserting portion **91***b*, which is connected to a connector side terminal **110**. The inserting portion **91***b* of each terminal **91**, which has a planar shape and extends parallel to the axial direction of the motor, is formed by bending part of the metal plate material so as to be overlapped in the thickness direction of the motor. A bent end **91***c* formed by bending the metal plate material at the inserting portion **91***b* faces the connector side terminal **110**. When manufacturing the brush holder **21**, the two terminals **91** are integrally formed and connected between the two holding wall portions **33**. The connecting part is cut after being fixed to the holding wall portion **33** to insulate the two terminals **91**.

As shown in FIG. **8**, the connector unit **4** includes a connector housing **100** coupled to the gear housing **61**. An external connecting portion **102** extends in the thickness direction at one side surface of the connector housing **101**. An insertion hole **102***a* extending to the interior of the connector housing **101** is arranged in the central part of the external connecting portion **102**. The insertion hole **102***a* is recessed in the thickness direction. The inner peripheral surface of the insertion hole **102***a* has a shape corresponding to the outer shape of the external connector (not shown) received by the insertion hole **102***a*. The external connecting portion **102** is surrounded by a substantially cylindrical connector boot **103**. The connector boot **103** prevents water from entering the insertion hole **102***a*. The connector boot **103** of the present embodiment is formed from an elastomer and is integrally molded with the connector housing **101**. The connector housing **101** is coupled to the gear housing **61** along the coupling direction X in the planar direction of the motor.

The connector housing **101** accommodates a box-shaped control circuit substrate **104**. The control circuit substrate **104** is formed by covering a circuit substrate, on which a plurality of electronic components are mounted, with an insulating resin material. The thickness direction of the substrate **104** is parallel to the axial direction of the motor. The control circuit substrate **104** is arranged so that one end in the longitudinal direction (one end in planar direction of motor) projects from the connector housing **101** towards the brush holder **21**. A substrate side terminal **104***a* extending in the planar direction of the motor is arranged at the projecting end of the control circuit substrate **104**. The connector unit **4** includes a connector terminal **105** electrically connected to the control circuit substrate **104**. One end of the connector terminal **105** extends into the insertion hole **53***a* of the external connecting portion **53** and is connected to the external connector that is inserted into the insertion hole **53***a*.

Two connector side terminals **110** (connection terminal) are held by the connector housing **101** at the upper axial side of the control circuit substrate **104**. Each connector side terminal **110** has a first connecting piece **110***a* extended towards the brush holder **21** and connected to the terminal **91**. The first connecting piece **110***a* is bifurcated (shaped like a tuning fork) when viewed in the axial direction, and the inserting portion **91***b* of the terminal **91** is inserted between the bifurcated part. The inserting portion **91***b* is elastically sandwiched by the first connecting piece **110***a* in the thickness direction of the motor (direction orthogonal to plane of drawing in FIG. **8**). This electrically connects the connector side terminal **110** and the terminal **91**. The first connecting piece **110***a* is inclined to the opposite side of the yoke in the axial direction. In other words, the first connecting piece **110***a* extends away from the yoke in the axial direction. Thus, the dimension of the first connecting piece **110***a* in the radial direction of the motor can be kept small while ensuring a proper length for the first connecting piece **110** that facilitates insertion of the terminal **91**. Each connector side terminal **110** includes a second connecting piece **110***b* extending in the shape of a crank shape. The second connecting piece **110***b* is electrically connected to the substrate side terminal **104***a* of the control circuit substrate **104** by welding.

The connector unit **4** having such a structure is coupled to the gear housing **61** along the planar direction (coupling direction X) of the motor **1**. The inserting portion **91***b* is inserted to the first connecting piece **110***a* by the assembly of the connector unit **4** in the coupling direction X. The first

connecting piece **110***a* sandwiches the inserting portion **91***b* in the thickness direction of the motor with its elastic force to electrically connect each connector side terminal **110** and each terminal **91**.

In the structure shown in FIGS. **8** and **9**, each terminal **91** serving as the conductive member is arranged to sandwich the yoke **11** with the commutator (cover **24**). This suppresses enlargement of the motor **1** in the radial direction.

The present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalence of the appended claims.

I claim:

1. A motor comprising:

a motor unit that outputs rotational drive force, wherein the motor unit includes

a yoke housing having an open end in an axial direction,

a commutator,

a power supply brush that supplies power to the commutator,

a conductive member electrically connected to the power supply brush, and

a brush holder arranged in the open end to hold the commutator, the power supply brush, and the conductive member; and

a deceleration unit including,

a gear housing coupled to the open end, and

a deceleration mechanism arranged in the gear housing to decelerate and output the rotational drive force of the motor unit, wherein

the commutator and the power supply brush are arranged outside the yoke housing,

the conductive member and the yoke housing are arranged on opposite sides of the commutator,

the brush holder includes a cover having an outer circumferential wall portion, which substantially covers an outer periphery of the commutator and a circular wall portion, which substantially covers an axial end face of the commutator,

the power supply brush extends from outside the outer circumferential wall portion of the cover toward inside the outer circumferential wall so that a distal end of the power supply brush positions at the inside of the outer circumferential wall portion,

the circular wall portion has a holder that holds the conductive member, and

the conductive member is arranged so that at least part of the conductive member overlaps the commutator in the axial direction.

2. The motor according to claim **1**, wherein the holder being configured so that the conductive member is coupled from an opposite side of the yoke housing to the holder in the axial direction.

3. The motor according to claim **2**, wherein the holder is arranged so that at least part of the holder overlaps the commutator in the axial direction.

4. The motor according to claim **1**, wherein

the commutator includes a first end face facing the yoke housing and an opposite second end face, and

the cover covers the second end face of the commutator.

5. The motor according to claim **1**, further comprising a connector unit coupled to the gear housing and including a connection terminal electrically connected to the conductive member, wherein

the conductive member includes a terminal portion having an elastic bifurcated section, and

the connection terminal is inserted into the bifurcated section of the terminal portion and elastically sandwiched by the bifurcated section.

6. The motor according to claim **5**, wherein

the bifurcated section includes a basal end divided into two, and

the holder holds the bifurcated section at a part closer to a distal end than the basal end.

7. The motor according to claim **1**, further comprising a connector unit coupled to the gear housing and including a connection terminal electrically connected to the conductive member, wherein

the connector unit is coupled to the gear housing along a predetermined coupling direction, and

the conductive member includes a hook contactable with the brush holder in the coupling direction.

8. The motor according to claim **1**, wherein the conductive member is planar and includes a planar surface parallel to an axis of the motor unit.

9. The motor according to claim **1**, further comprising a connector unit coupled to the gear housing and including a connection terminal electrically connected to the conductive member, wherein

the brush holder holds an electric component, which is electrically connected to the conductive member, and is arranged so that the brush holder and the yoke housing are located on opposite sides of the commutator; and

the conductive member is substantially U-shaped and includes a first terminal portion and a second terminal portion, which extend in a direction orthogonal to an axis of the motor unit and face the same direction with respect to each other, and an intermediate portion, which connects the terminal portions, wherein the connection terminal of the connector unit is connected to the first terminal portion, and a conductive wire extends from the power supply brush to the second terminal portion.

10. The motor according to claim **9**, wherein the first and second terminal portions of the conductive member are arranged parallel to the direction orthogonal to the axial direction of the motor unit.

11. The motor according to claim **1**, further comprising a connector unit coupled to the gear housing and including a connection terminal electrically connected to the conductive member.

12. The motor according to claim **1**, wherein the conductive member extends along a line that is orthogonal to an axis of a rotation shaft and lies along a planar direction of the motor.

13. The motor according to claim **1**, wherein if the axis of the rotation shaft formed an imaginary line dividing two planes, the conductive member extend across the plane divided by the imaginary line.

14. A motor comprising:

a motor unit that outputs rotational drive force, wherein the motor unit includes

a yoke housing having an open end in an axial direction,

a commutator,

a power supply brush that supplies power to the commutator,

a conductive member electrically connected to the power supply brush, and

a brush holder arranged in the open end to hold the commutator, the power supply brush, and the conductive member; and

a deceleration unit including,

a gear housing coupled to the open end, and

a deceleration mechanism arranged in the gear housing to decelerate and output the rotational drive force of the motor unit, wherein

the commutator and the power supply brush are arranged outside the yoke housing,

the conductive member and the yoke housing are arranged on opposite sides of the commutator,

the brush holder includes a cover having an outer circumferential wall portion, which substantially covers an outer periphery of the commutator and a circular wall portion, which substantially covers an axial end face of the commutator,

the power supply brush extends from outside the outer circumferential wall portion of the cover toward inside the outer circumferential wall so that a distal end of the power supply brush positions at the inside of the outer circumferential wall portion,

the circular wall portion has a holder that holds the conductive member,

the holder is configured so that the conductive member is coupled from an opposite side of the yoke housing to the holder in the axial direction, and

the holder is arranged so that at least part of the holder overlaps the commutator in the axial direction.

15. A motor comprising:

a motor unit that outputs rotational drive force, wherein the motor unit includes

a yoke housing having an open end in an axial direction,

a commutator,

a power supply brush that supplies power to the commutator,

a conductive member electrically connected to the power supply brush, and

a brush holder arranged in the open end to hold the commutator, the power supply brush, and the conductive member;

a deceleration unit including,

a gear housing coupled to the open end, and

a deceleration mechanism arranged in the gear housing to decelerate and output the rotational drive force of the motor unit; and

a connector unit coupled to the gear housing and including a connection terminal electrically connected to the conductive member, wherein

the commutator and the power supply brush are arranged outside the yoke housing,

the conductive member and the yoke housing are arranged on opposite sides of the commutator,

the brush holder includes a cover having an outer circumferential wall portion, which substantially covers an outer periphery of the commutator and a circular wall portion, which substantially covers an axial end face of the commutator,

the power supply brush extends from outside the outer circumferential wall portion of the cover toward inside the outer circumferential wall so that a distal end of the power supply brush positions at the inside of the outer circumferential wall portion,

the circular wall portion has a holder that holds the conductive member,

the connector unit is coupled to the gear housing along a predetermined coupling direction, and

the conductive member includes a hook contactable with the brush holder in the coupling direction.

16. A motor comprising:

a motor unit that outputs rotational drive force, wherein the motor unit includes

a yoke housing having an open end in an axial direction,

a commutator,

a power supply brush that supplies power to the commutator,

a conductive member electrically connected to the power supply brush, and

a brush holder arranged in the open end to hold the commutator, the power supply brush, and the conductive member;

a deceleration unit including,

a gear housing coupled to the open end, and

a deceleration mechanism arranged in the gear housing to decelerate and output the rotational drive force of the motor unit; and

a connector unit coupled to the gear housing and including a connection terminal electrically connected to the conductive member, wherein

the commutator and the power supply brush are arranged outside the yoke housing,

the conductive member and the yoke housing are arranged on opposite sides of the commutator,

the brush holder includes a cover having an outer circumferential wall portion, which substantially covers an outer periphery of the commutator and a circular wall portion, which substantially covers an axial end face of the commutator,

the power supply brush extends from outside the outer circumferential wall portion of the cover toward inside the outer circumferential wall so that a distal end of the power supply brush positions at the inside of the outer circumferential wall portion,

the circular wall portion has a holder that holds the conductive member,

the brush holder holds an electric component, which is electrically connected to the conductive member, and is arranged so that the brush holder and the yoke housing are located on opposite sides of the commutator; and

the conductive member is substantially U-shaped and includes a first terminal portion and a second terminal portion, which extend in a direction orthogonal to an axis of the motor unit and face the same direction with respect to each other, and an intermediate portion, which connects the terminal portions, wherein the connection terminal of the connector unit is connected to the first terminal portion, and a conductive wire extends from the power supply brush to the second terminal portion.

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